

# Adapting Ecosystems to Climate Change



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**An ecosystem is a group of plants and animals that are highly interactive with each other and their environment.**

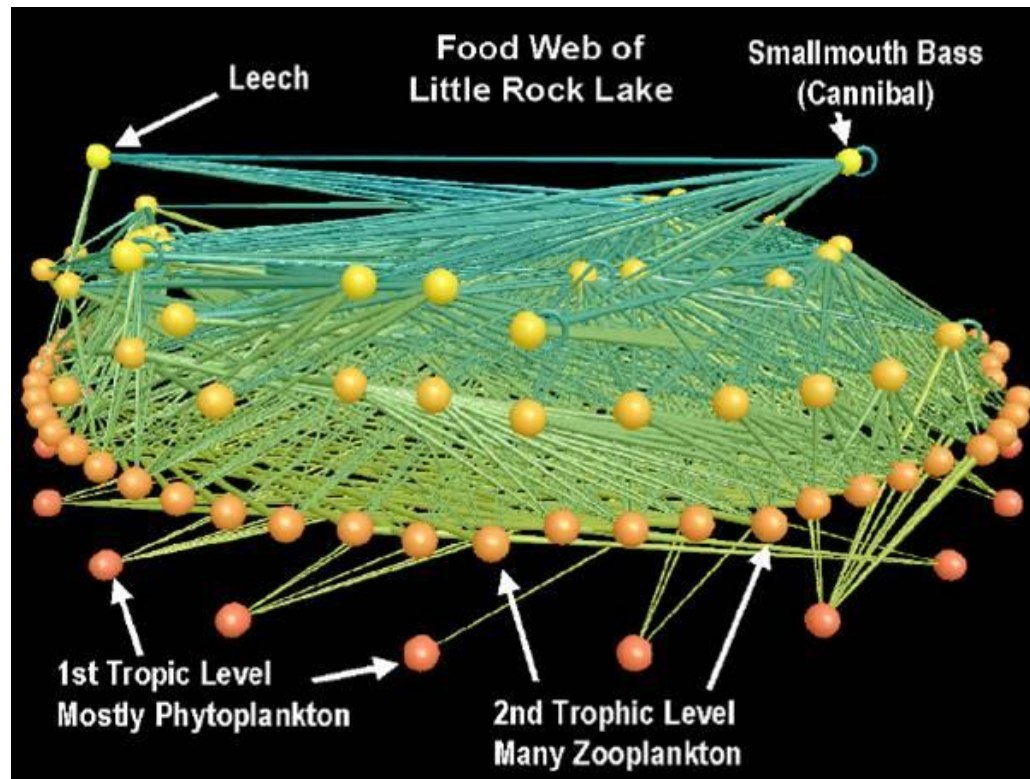








**The complexity of an ecosystem (composition, structure, and function) is a pretty good indicator of its ability to adapt to changing conditions.**



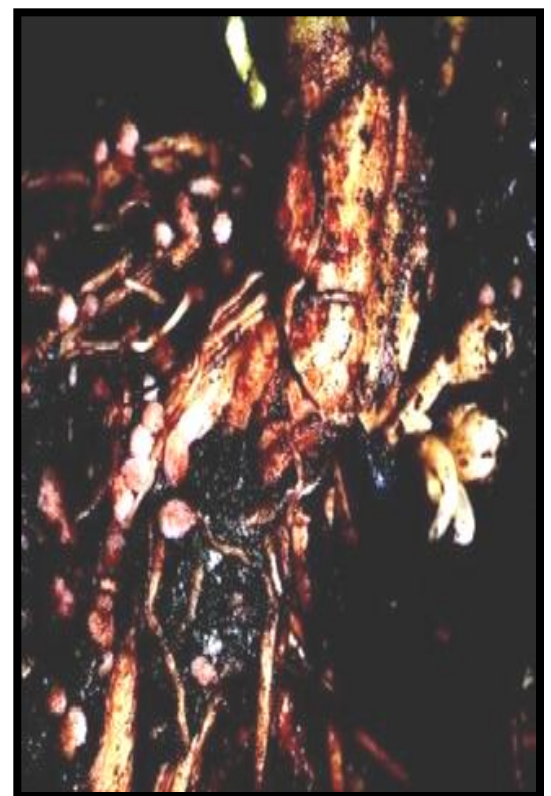
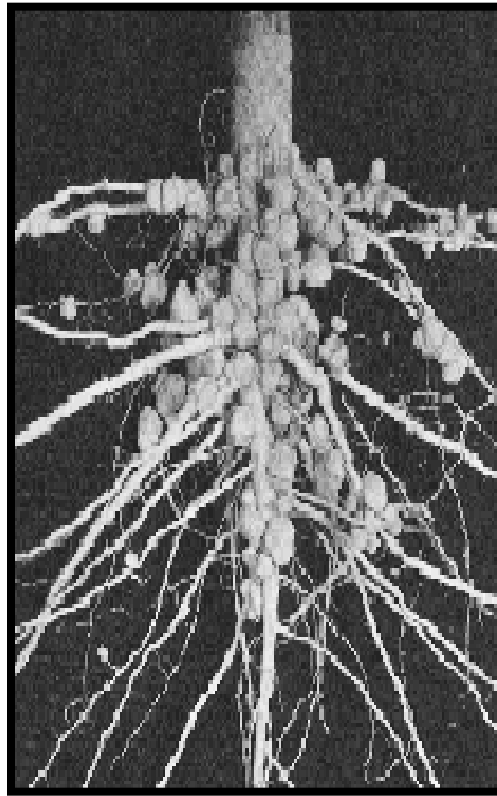


**DEPARTMENT OF REDUNDANCY DEPARTMENT**





# Nitrogen Fixation X Drought





# **Agricultural monocultures are vulnerable**





**The enemy of adaptive  
capacity =**

**Simplification =**

**Loss of diversity of  
composition,  
structure, and/or  
function =**

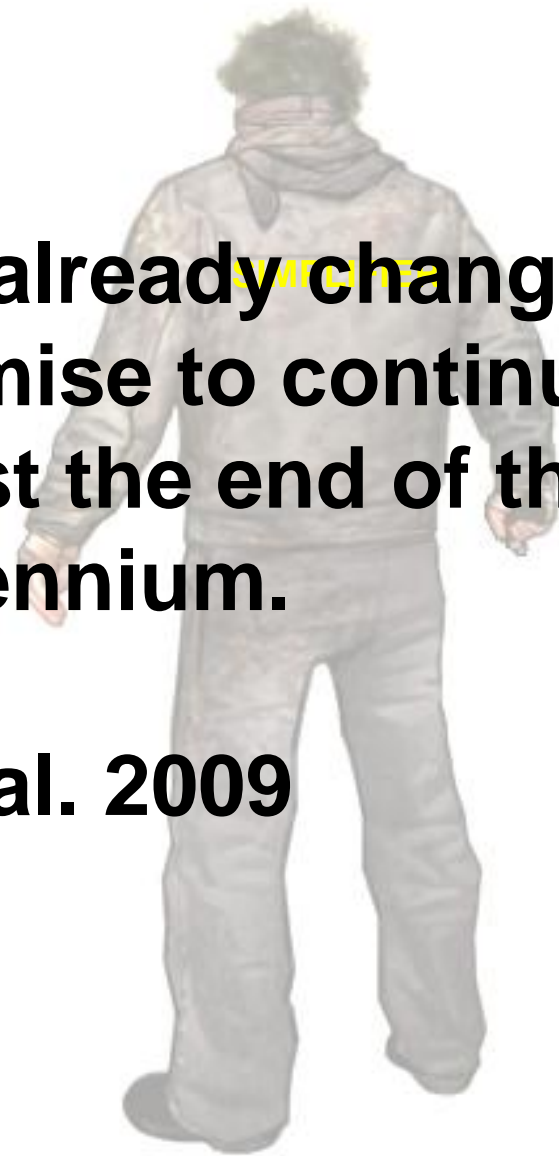
**Loss of redundancy  
(options).**





**Human actions have already changed the climate, and promise to continue doing so until at least the end of the current millennium.**

**Solomon et al. 2009**

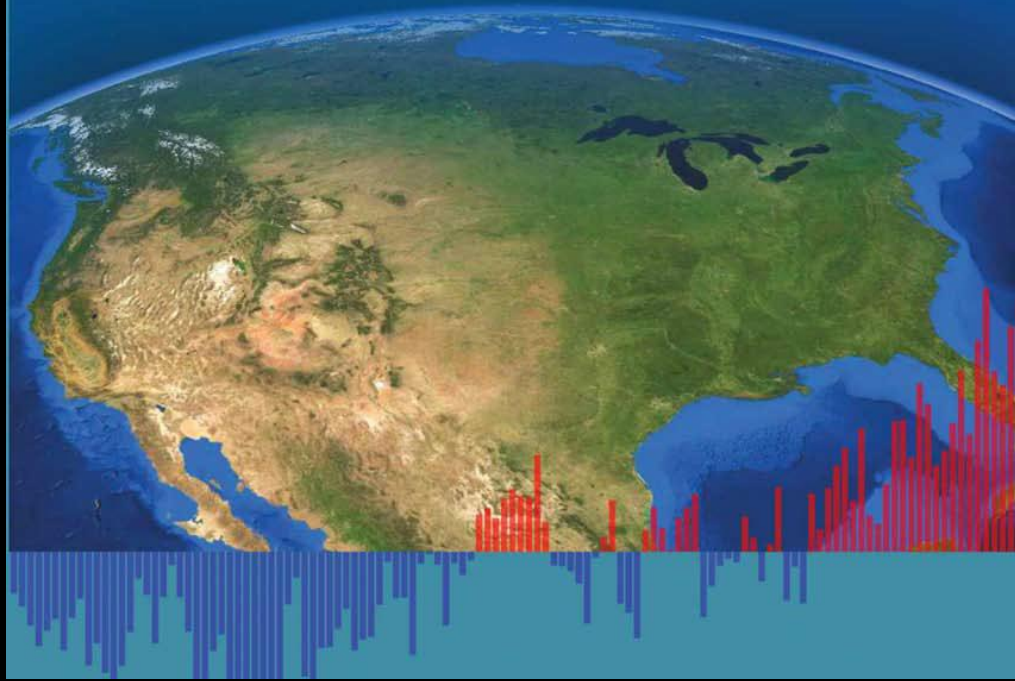




# Global Climate Change Impacts

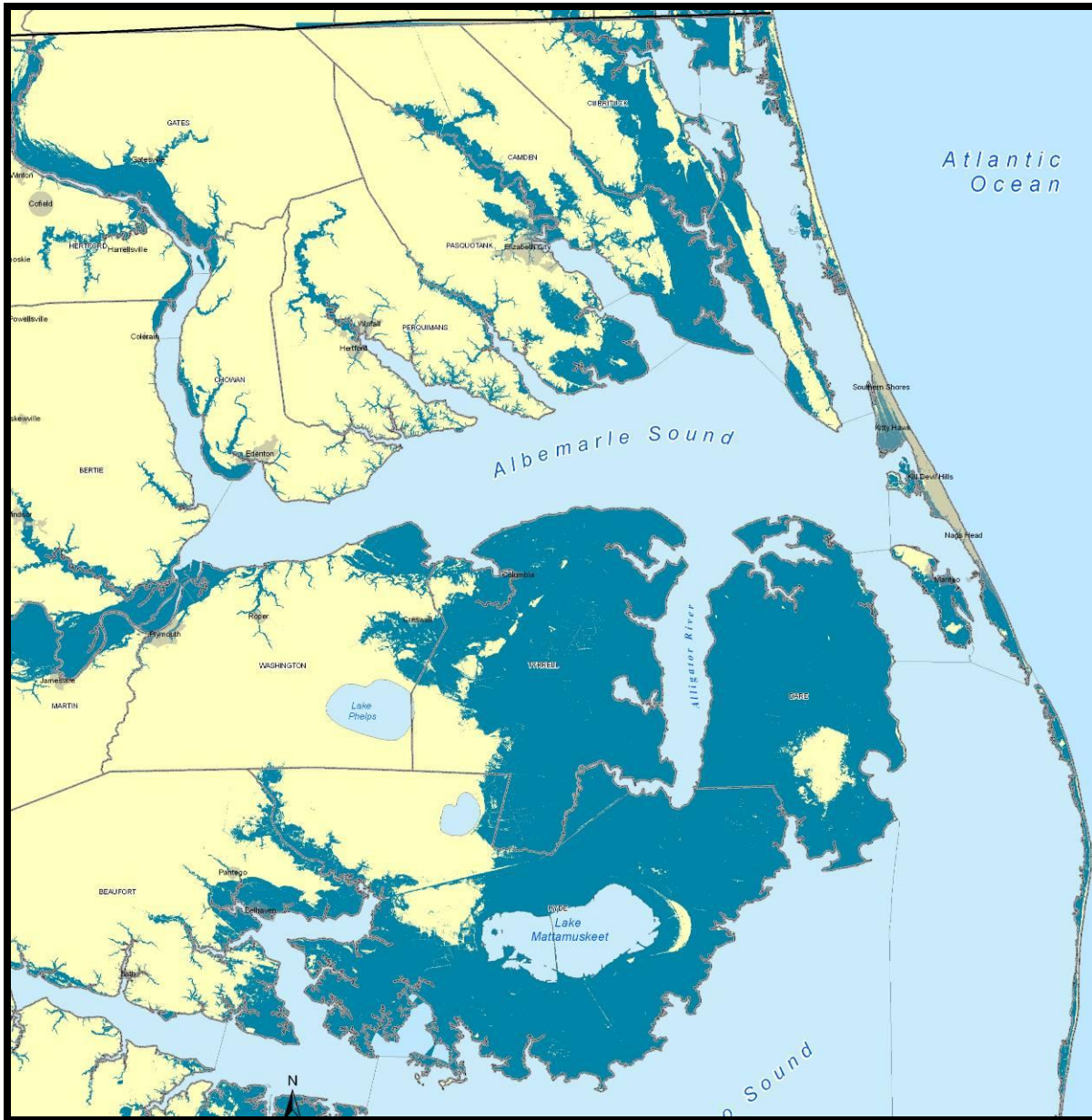
IN THE UNITED STATES

U.S. GLOBAL CHANGE  
RESEARCH PROGRAM



**Warming of  
3.5-5 F°  
results in  
20-30% of  
species  
living far  
outside  
their current  
ranges  
(page 82)**





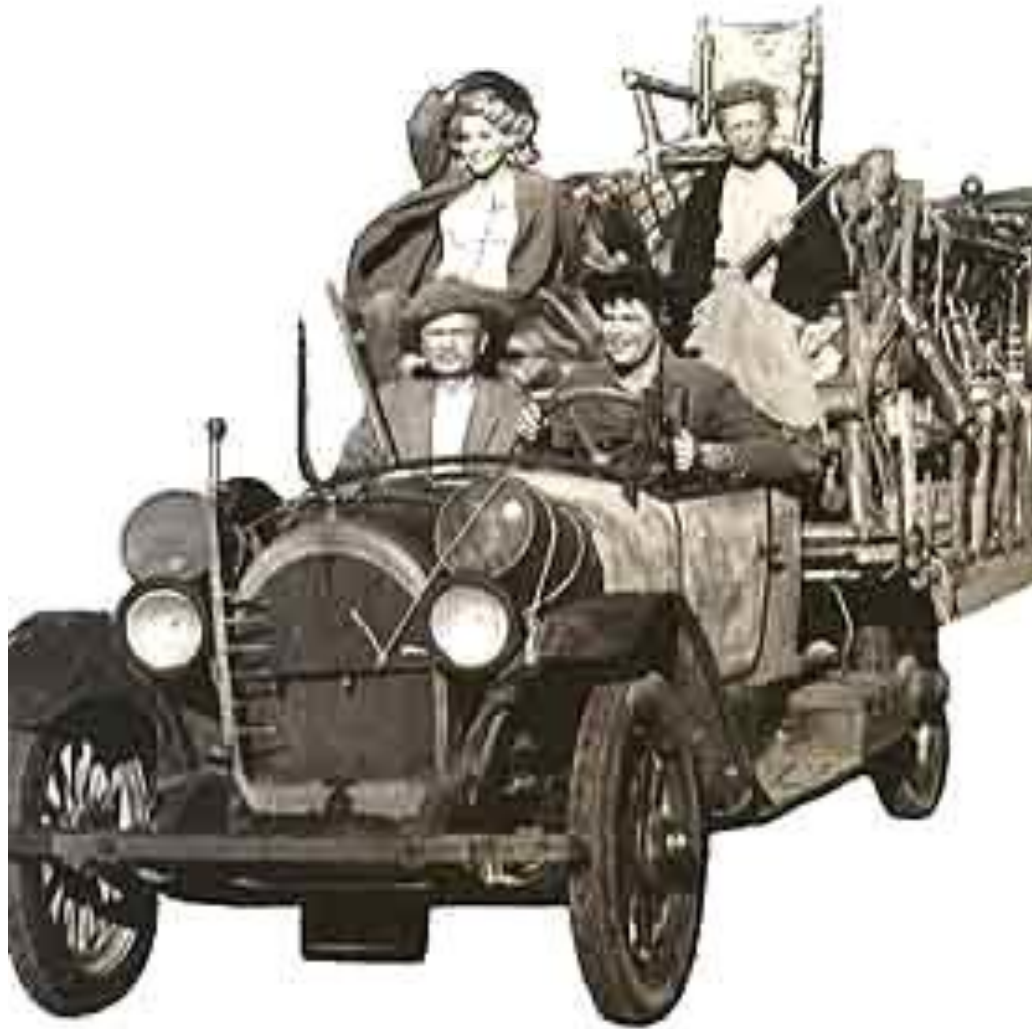
**The  
Albemarle  
under one  
meter of  
water.**



**It would be nice if plants, animals, and people could all adapt to the changes that are happening, and stay right where they are.**







**Many plants and animals and people  
are simply going to have to move!**



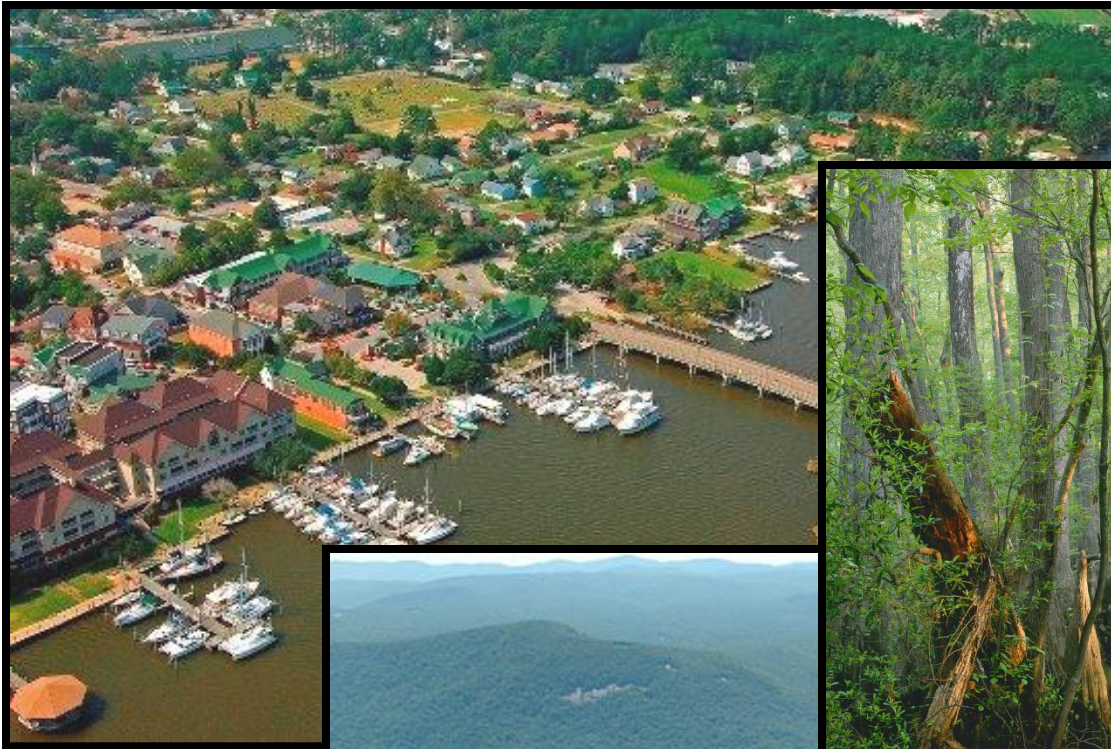
# Moving means different things to different species and systems.















**Some  
disassembly  
required!**



**Should Move**

**Should Stay**

**Needs  
Help**

**!!**

**!!**

**Doesn't  
Need  
Help**

**?**

**?**



**Should Move**

**Should Stay**

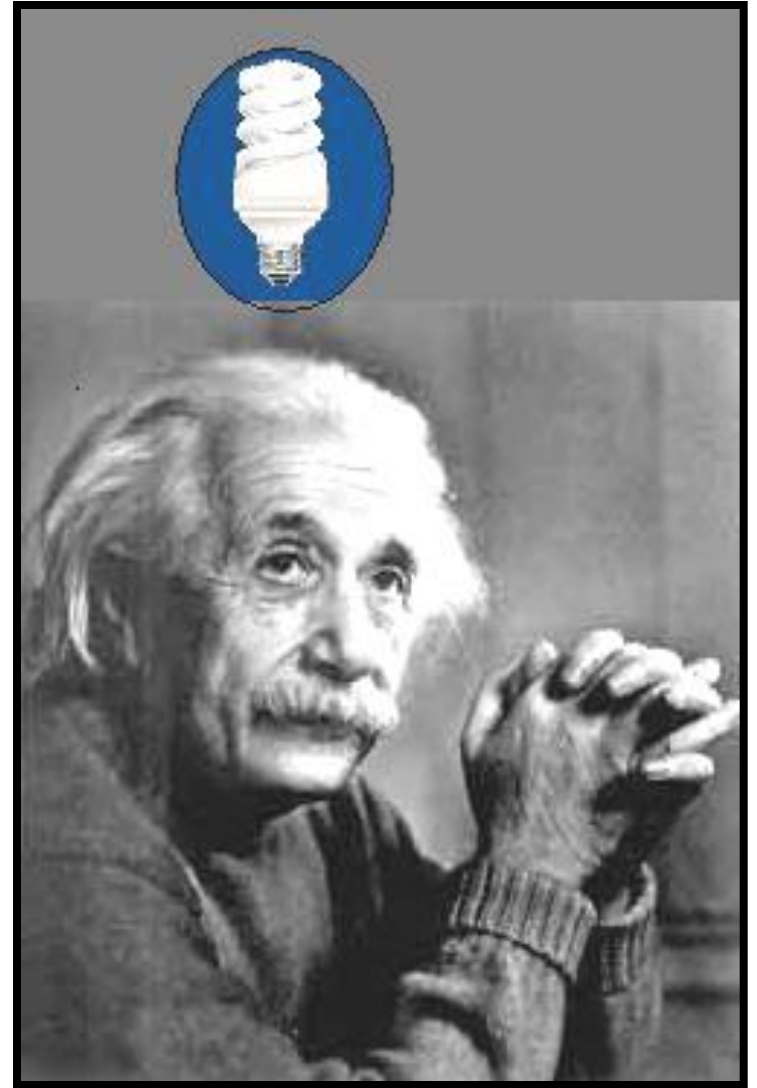
**Needs  
Help**

**!!**

**!!**



**A planner, whether  
focused on  
conservation of  
species or agricultural  
production or local  
economic viability  
now needs to be  
focused on decisions  
about movement and  
local resilience in  
response to change.**





**The Hokey Pokey  
really is what it's all about!**





**The Hokey Pokey  
really is what it's all about!**

**Movement in...**

**Movement out...**

**Shake it all about...**

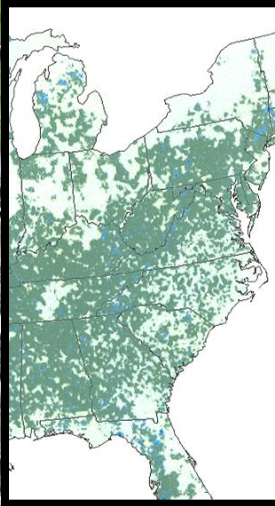


## **DEFINITION:**

**An invasive species (invader) is one that causes the ecosystem to simplify.**







UGA2307129



UGA3225077

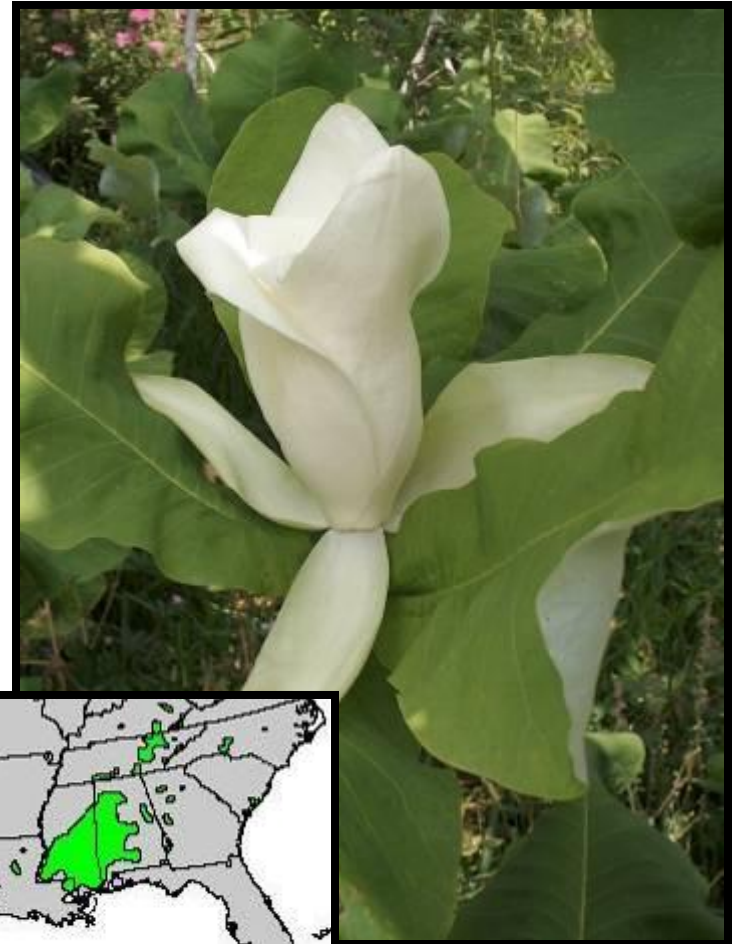
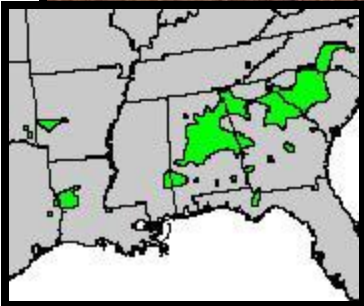








**But not all new  
species will be  
invasive.**









**Which  
movements are  
most likely to  
result in  
simplification  
and which will  
most likely  
conserve  
complexity?**





# We need predictive models!



**OR**





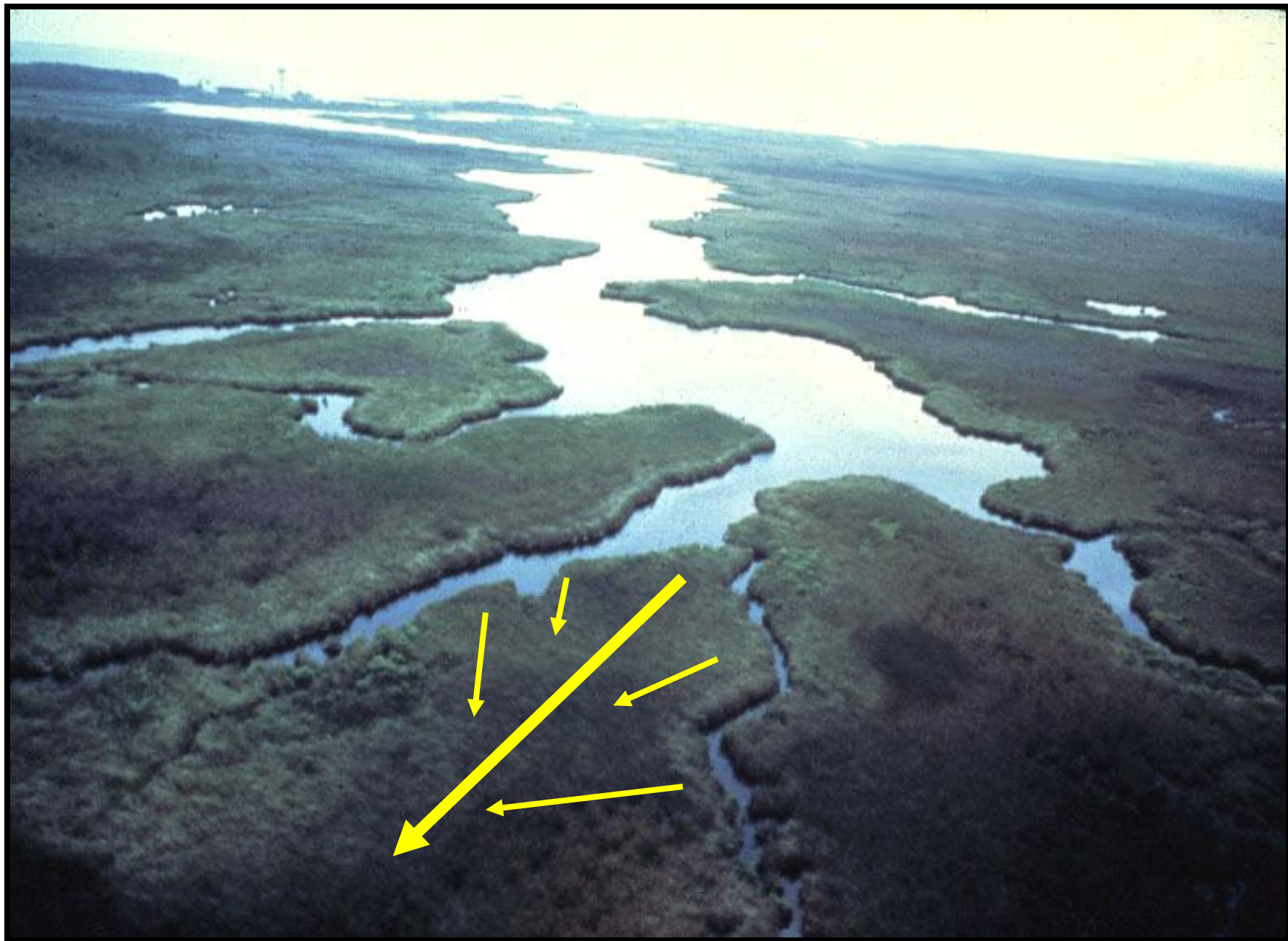
**The Hokey Pokey  
really is what it's all about!**

**Movement in...**

**Movement out...**

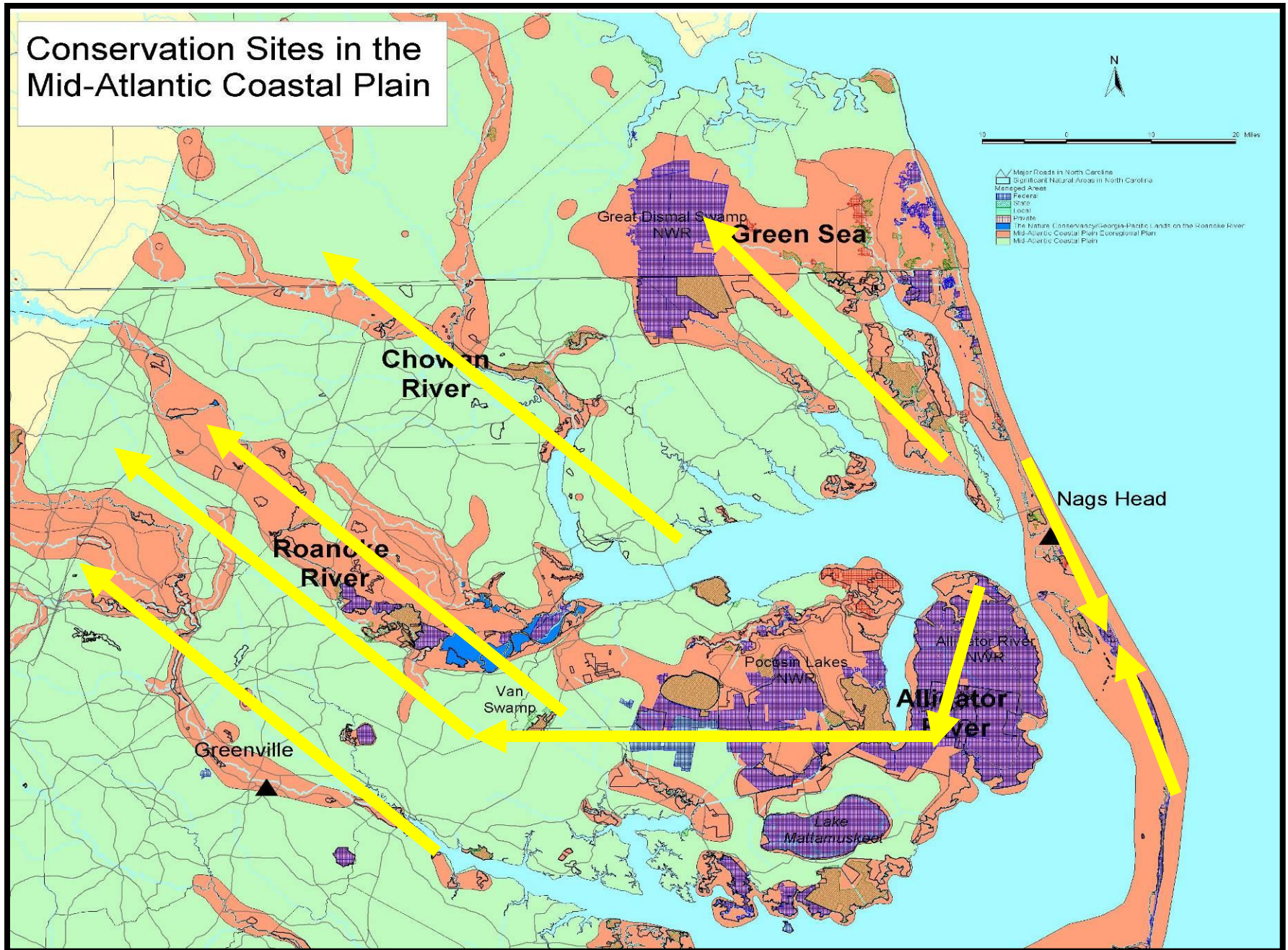
**Shake it all about...**







# Conservation Sites in the Mid-Atlantic Coastal Plain







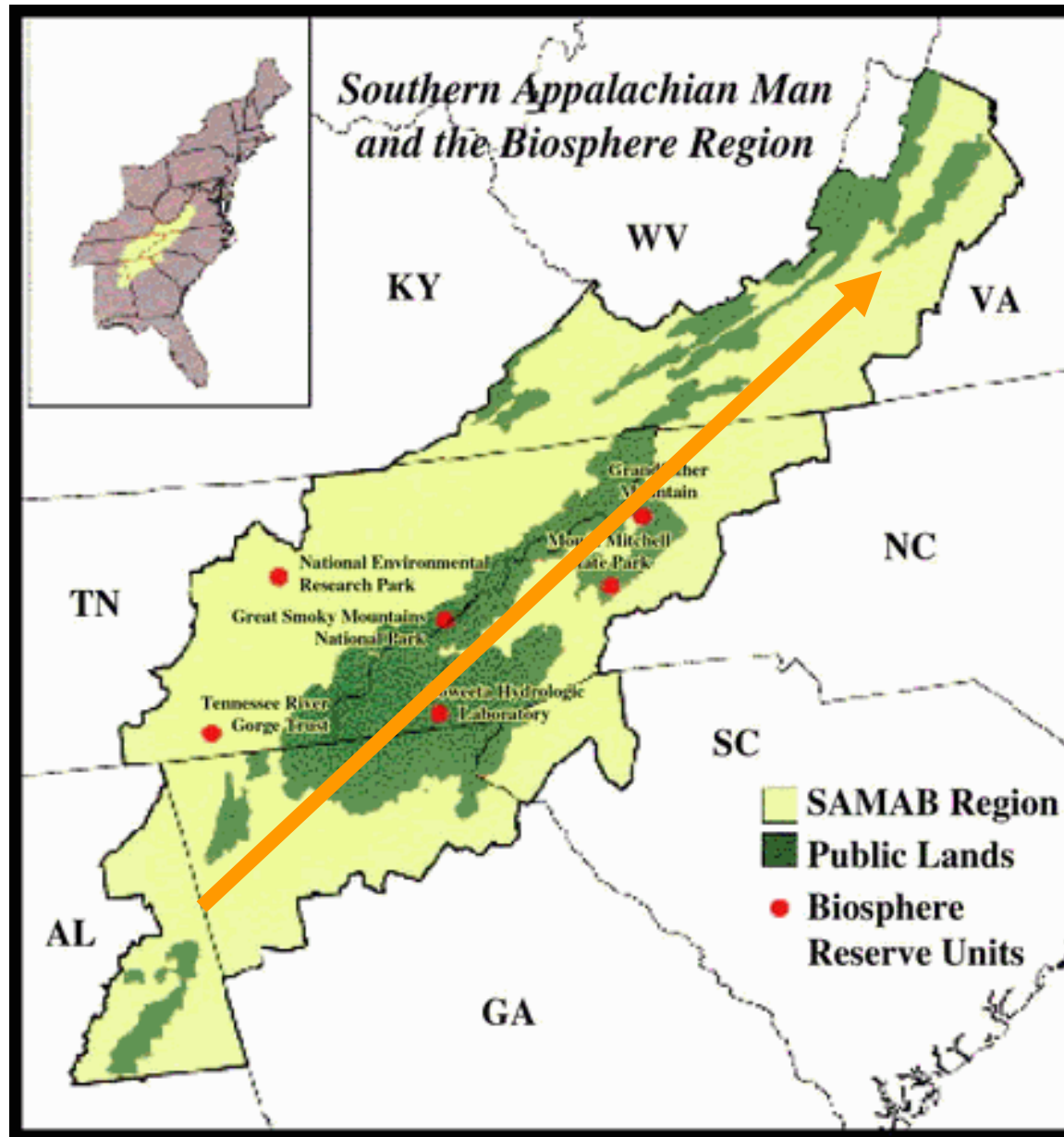


**Moving up slope in the mountains is really hard, because:**

- 1. Soils vary a lot with elevation.**
- 2. Habitat areas decline rapidly with elevation.**
- 3. Many species occupy very narrowly defined habitats.**

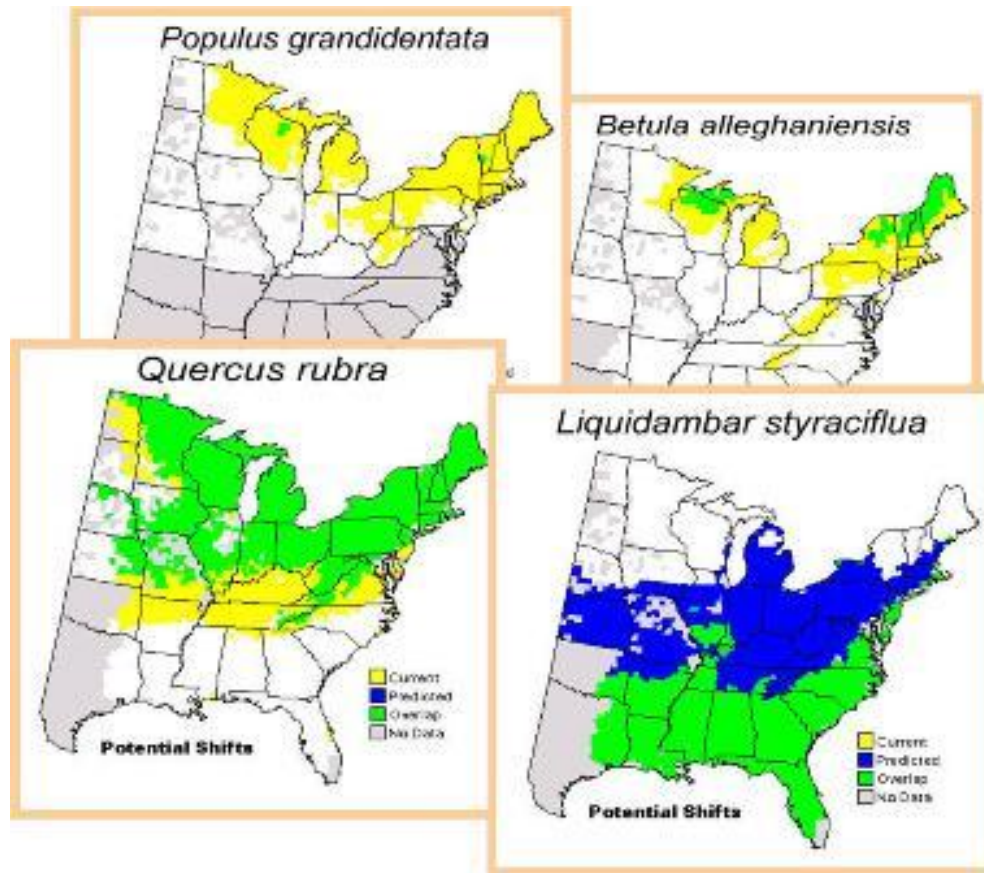








**Treat future  
range maps  
with caution!**





**BROOKINGS**

FORWARD THINKS / DISPATCH

WELL,  
DUH-H-H!...

**CLIMATE  
SHIFTS  
BUT SOILS  
AND TOPO  
STAY PUT?**



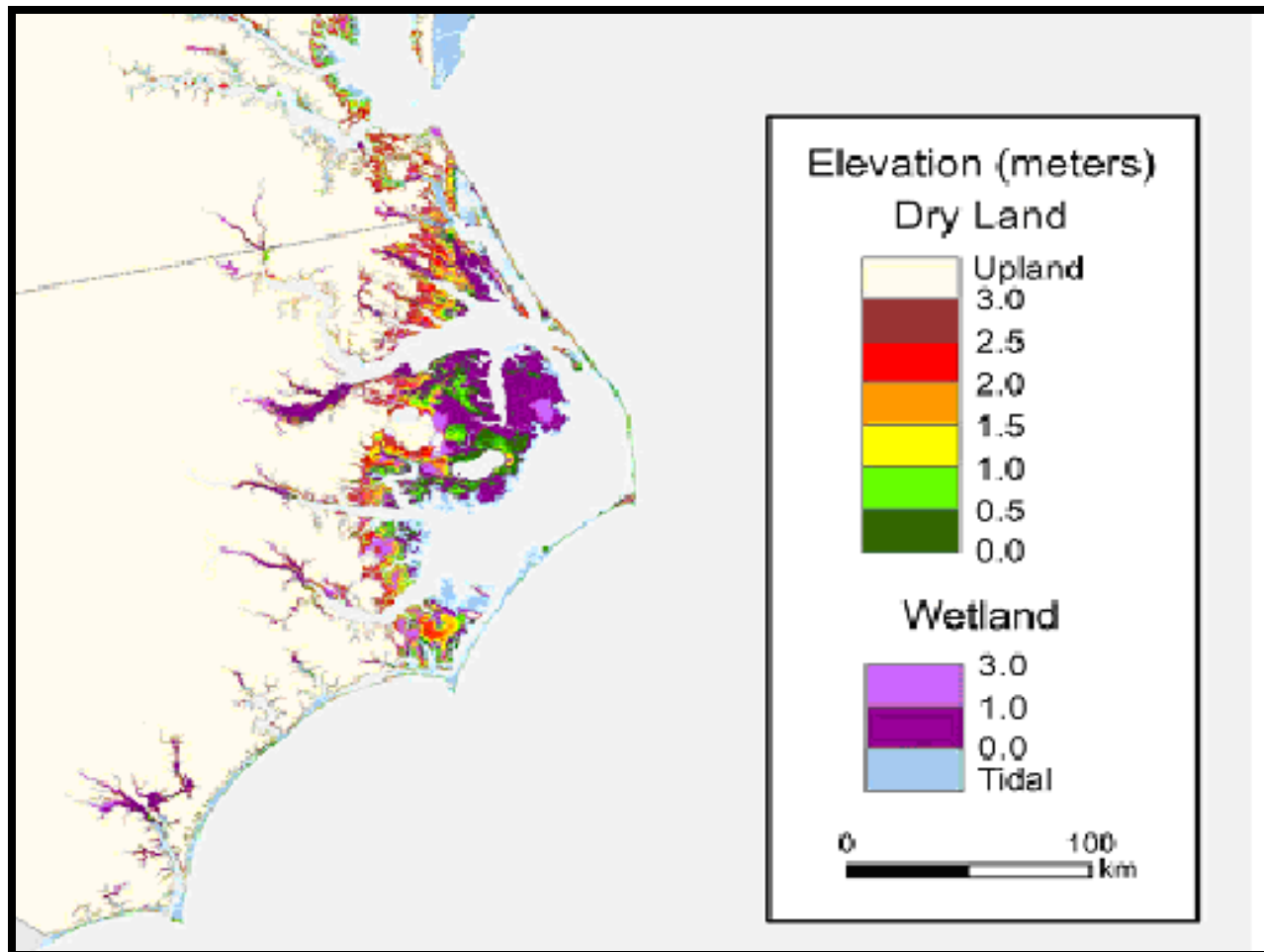


**Things will get  
out of synch!**





# What about people – farms, managed forests, houses, and towns?









# **What is likely to encourage people to move?**

- **Market incentives**
- **Market disincentives**
- **Government incentives**
- **Government disincentives**



**The Hokey Pokey  
really is what it's all about!**

**Movement in...**

**Movement out...**

**Shake it all about...**











**Last 500 years.**



**Last 50  
years.**





**Last 5 years  
(post-Katrina)  
\$100 Billion**





